Baldwin Hills Air Quality Study

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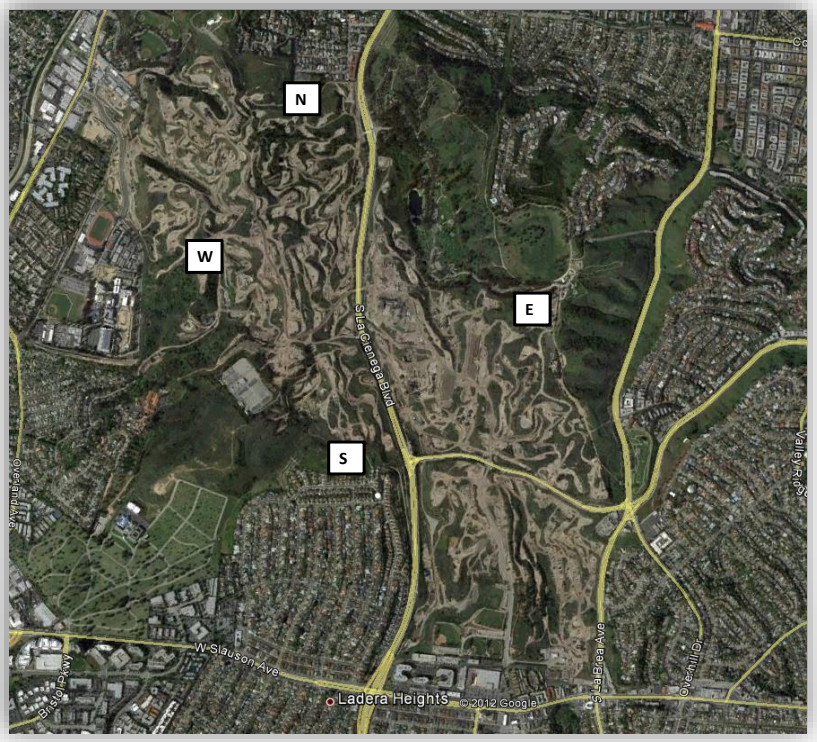
Outline

- Background and objectives
- Methods
- Results
- Summary

Motivation

- Multiple community groups were concerned with potential pollutant impacts from oil field activities.
- Conducted a 1-year study as part of a settlement about an Environmental Impact Report (EIR) on oil field development.



Aerial view of the Inglewood Oil Field, showing the locations of the four monitoring sites: north (N), east (E), south (S), and west (W).

Objectives (1)

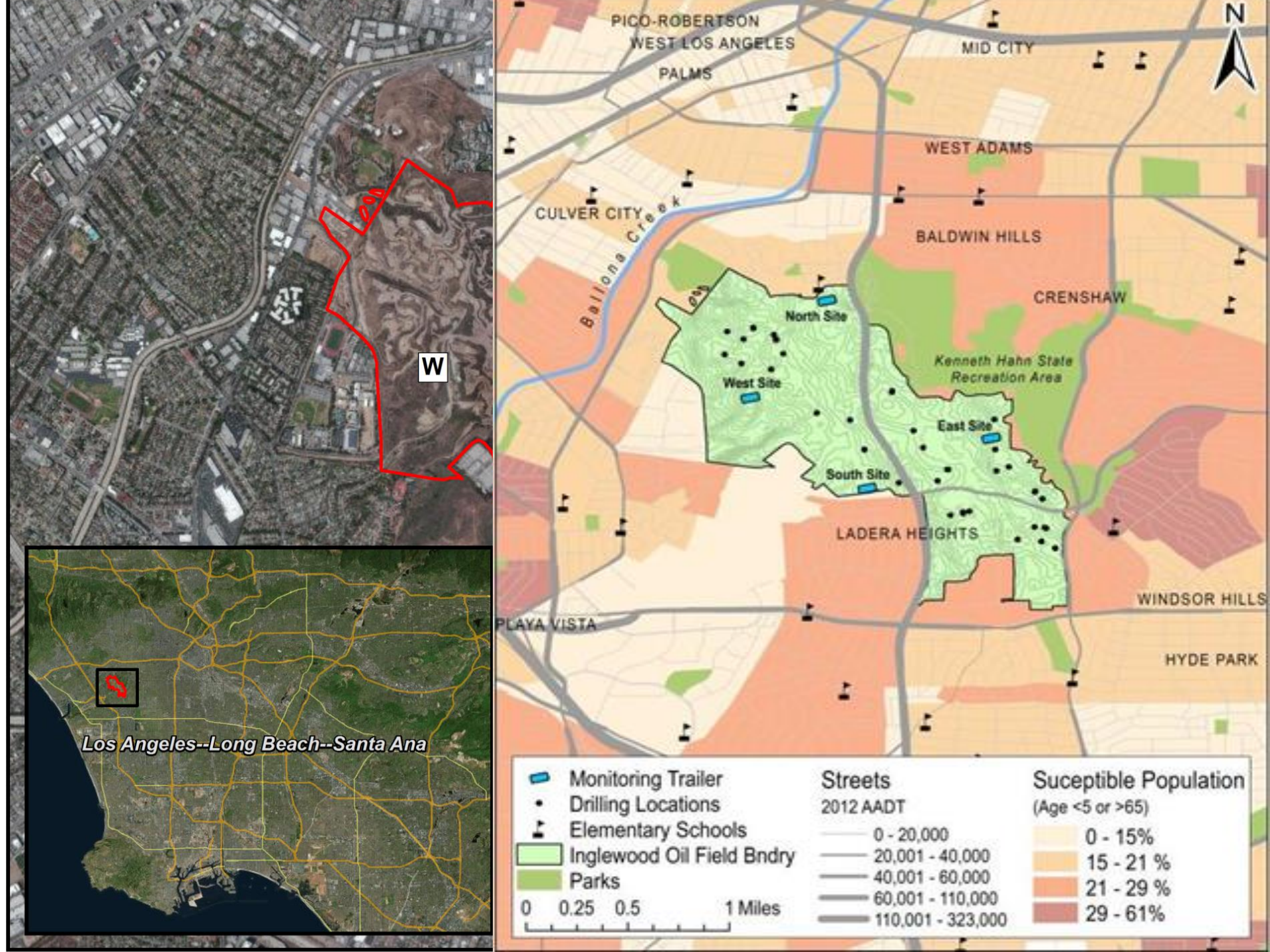
Primary project objectives

- Quantify air toxics emissions from Inglewood Oil Field operations.
- Assess the health risk of acute and chronic exposure to air toxics emitted from oil field operations.

Objectives (2)

Secondary project objectives (to the extent feasible)

- Determine and distinguish major sources of toxic air emissions within the areas surrounding Inglewood Oil Field.
- Assess the oil field's contribution to the overall acute and chronic health risk in the surrounding areas.


PICO-ROBERTSON
WEST LOS ANGELES
PALMS
MID CITY
N
WEST ADAMS
CULVER CITY
Ballona Creek
BALDWIN HILLS
CRENSHAW
North Site
West Site
Kenneth Hahn State Recreation Area
East Site
South Site
LADERA HEIGHTS
WINDSOR HILLS
PLAYA VISTA
HYDE PARK
W
Los Angeles--Long Beach--Santa Ana
Monitoring Trailer
Drilling Locations
Elementary Schools
Inglewood Oil Field Bndry
Parks
0 0.25 0.5 1 Miles
Streets
2012 AADT
0 - 20,000
20,001 - 40,000
40,001 - 60,000
60,001 - 110,000
110,001 - 323,000
Suceptible Population
(Age <5 or >65)
0 - 15%
15 - 21 %
21 - 29 %
29 - 61%

Challenges

- The oil field is in an urban area of 15 million people with other major sources (refineries, LAX, etc.) in the area.
- Houses have been built right up to the edge of the oil field.
- A regular diurnal wind pattern puts different parts of the nearby community downwind of the oil field during different parts of the day.
- It would be very expensive to monitor all air toxics at all impacted locations.

Prioritized Toxics of Concern

Key pollutants identified for characterization

- Diesel particulate matter (DPM)
- Cadmium, nickel, mercury, manganese, arsenic, lead
- Benzene, formaldehyde, acrolein

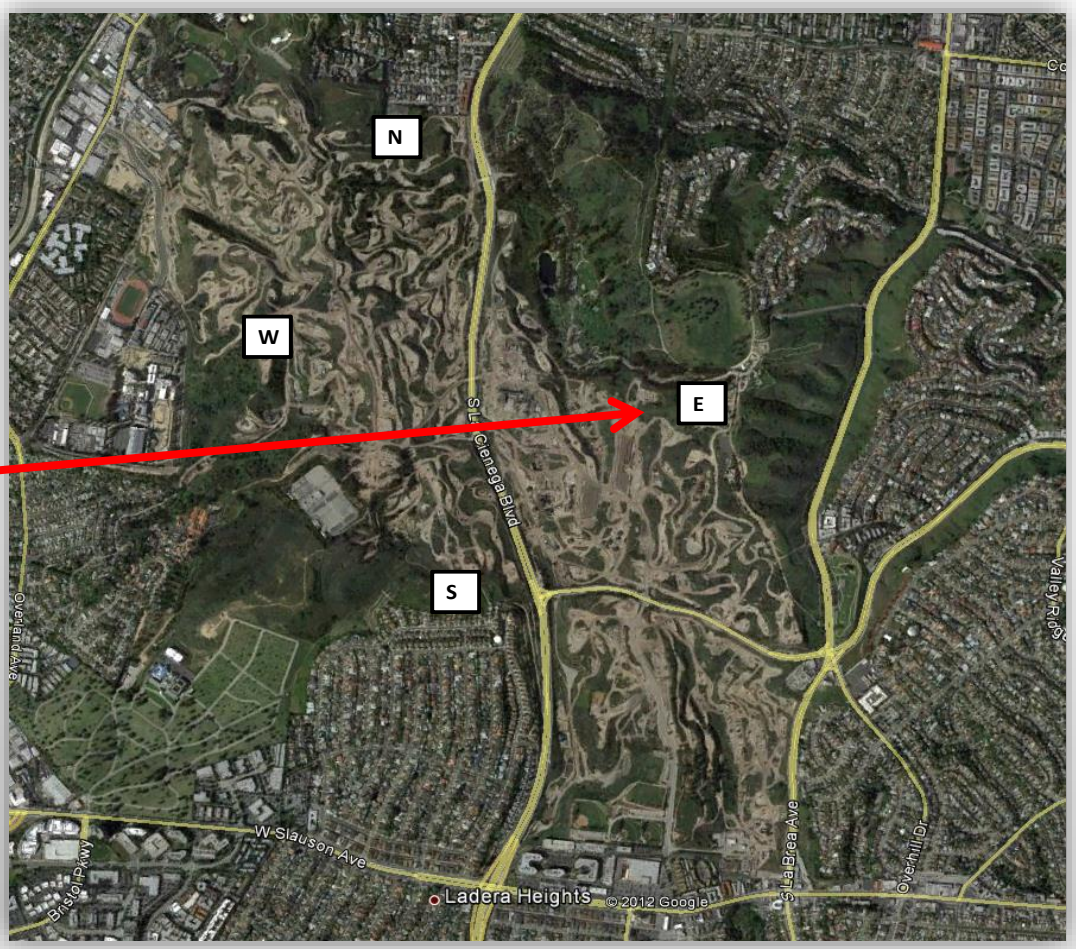
Addressing Challenges

- Collect high time-resolution data; daily or greater average data will not be as useful because wind patterns shift multiple times a day, making apportionment difficult.
- Select monitoring sites to
  - Represent highest and longest potential impact from the oil field
  - Determine the incremental change in ambient concentrations across the oil field
- All within a limited budget.

Monitoring Methods

- **Black carbon** (BC; as a proxy for DPM) by Teledyne-API Model 633 dual-wavelength Aethalometers.
- **24 metals** by XACT 625 semi-continuous X-ray fluorescence (XRF) spectrometer (e.g., S, K, Fe, Cu, Pb, Ni, Cd, As, Hg).
- **7 VOCs** by Proton-Transfer-Reaction Time-of-Flight Mass Spectrometry (PTR-TOFMS) (e.g., acrolein, benzene, butadiene, naphthalene, acetaldehyde).
- **Meteorology** for wind patterns, temperature, and humidity.

- Hourly BC at **all sites** 11/15/12-11/15/13
- Hourly metals 11/15/12-2/1/13
- 1-min VOCs 7/3/13-7/17/13
- Meteorology 11/15/12-11/15/13

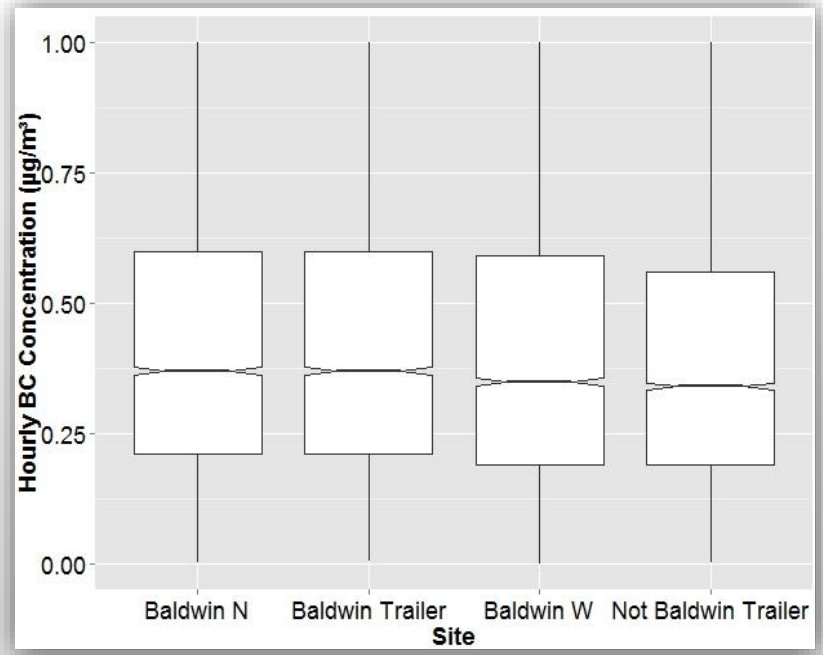


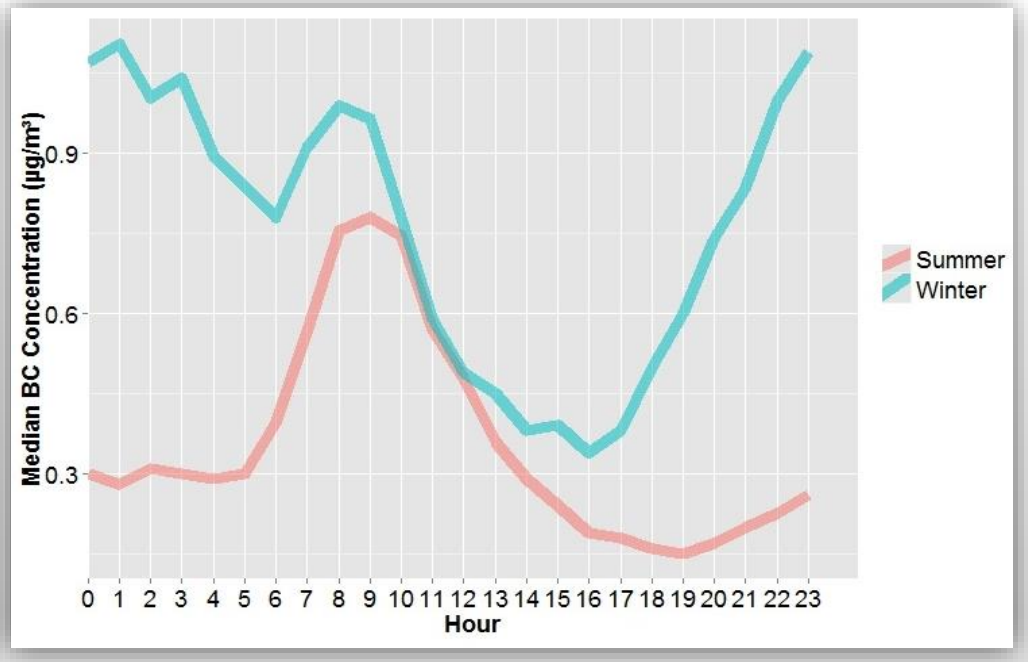
Results

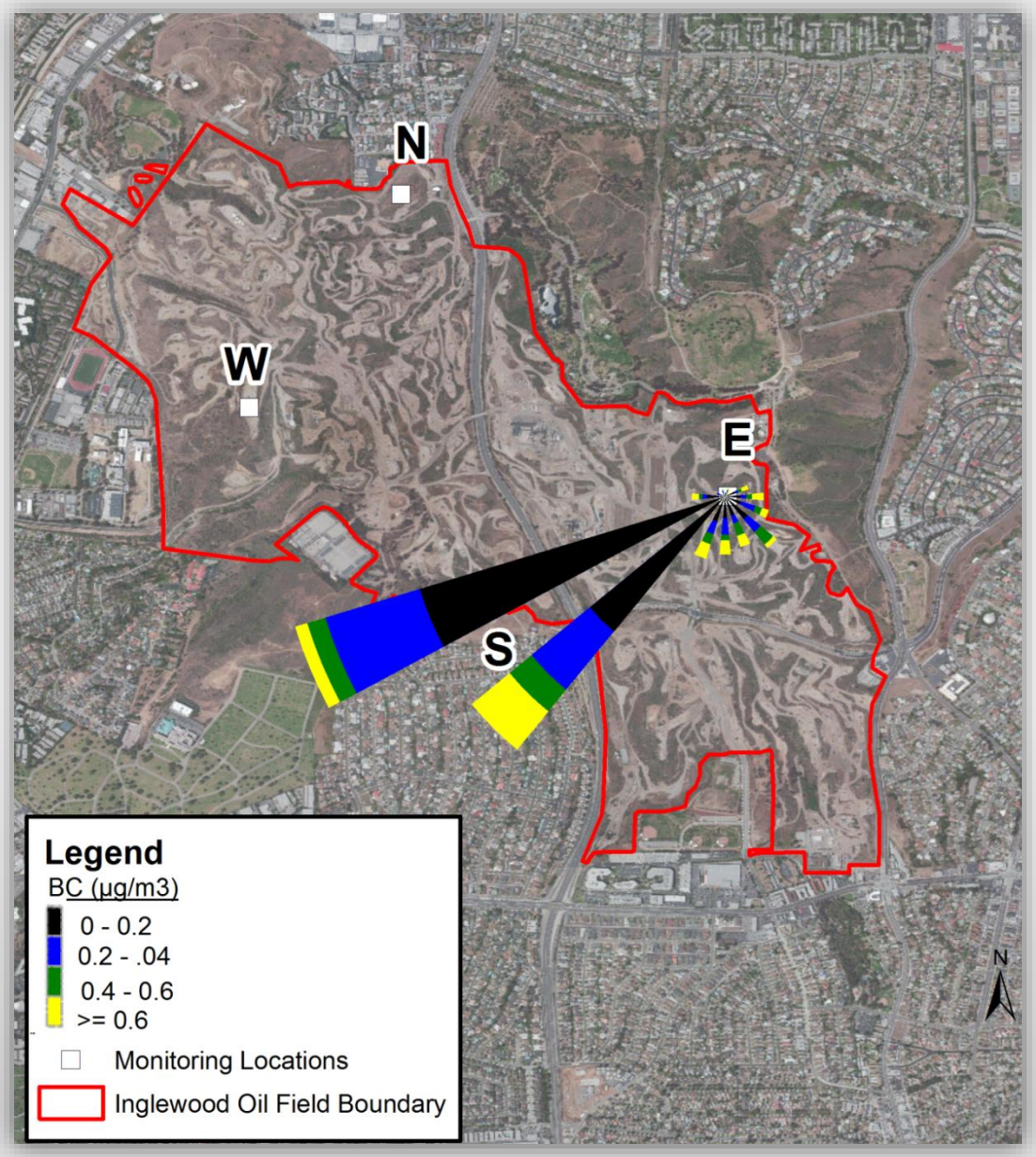
- Monitoring was completed in November 2013 and data analyzed to characterize
  - Temporal patterns of pollutants
  - Relative contribution of sources to pollutants
  - Hazard associated with oil field operations
- Currently working with Los Angeles County on follow-up analyses linking ambient concentrations with nearby vehicle activity and facility operations.

BC Concentrations

- BC was typically below 1 µg/m^3 at all sites.
- Morning peak in BC.
- Operations on oil field were 24/7/365, but drilling was limited to daytime only.





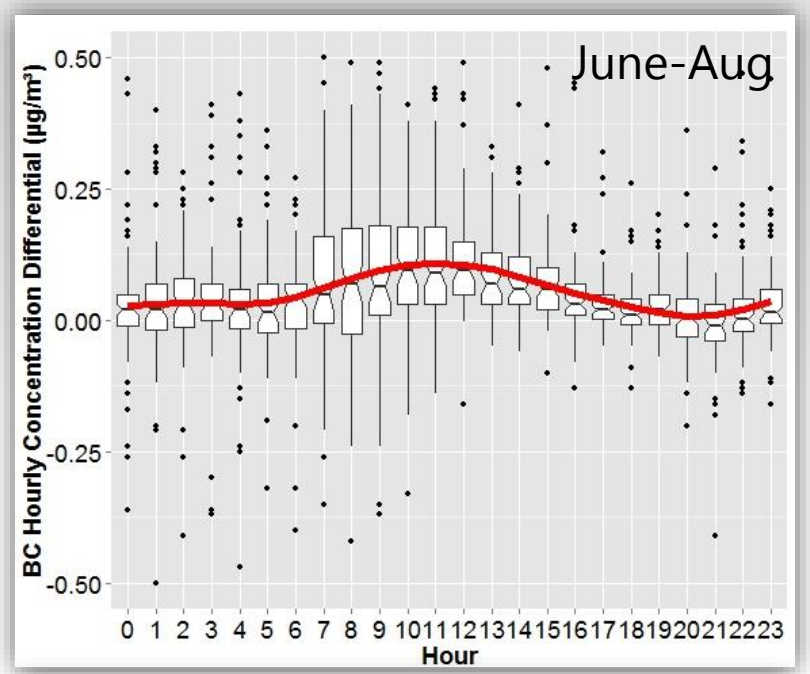


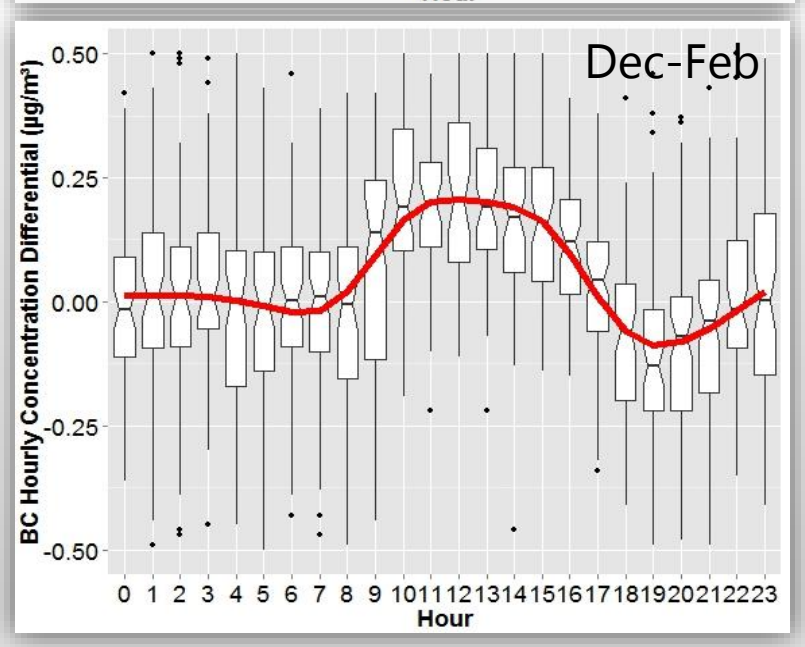
BC Differential

- Predominant west-southwest wind direction (53% of hours).
- We can use the difference between the S and E sites to quantify the contribution from the oil field area.

BC Differential

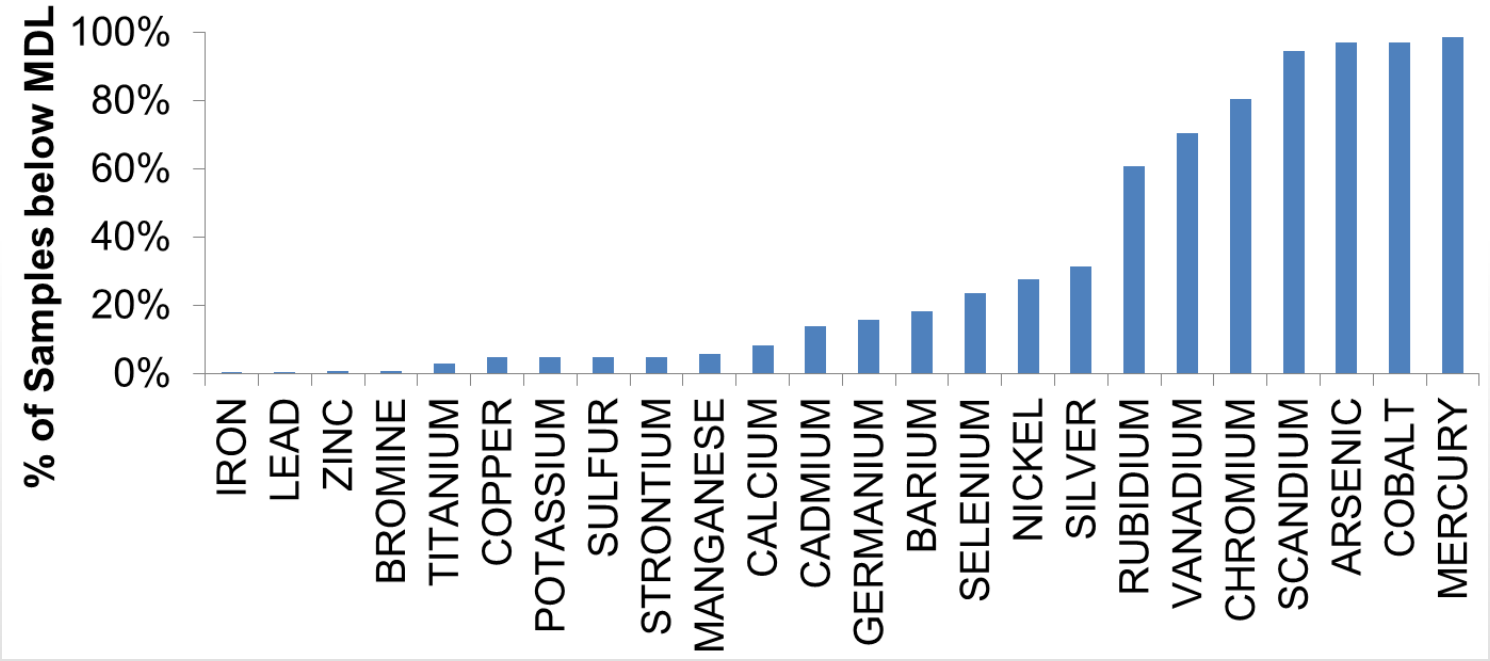
- Daytime concentrations of BC were consistently higher at the downwind site during daytime working hours.
- Overnight, when there were no operations, differential was typically zero.
- The differential indicates
  - Statistically significant BC from oil field operations
  - But with a contribution of ~ 0.1 μg/m^3





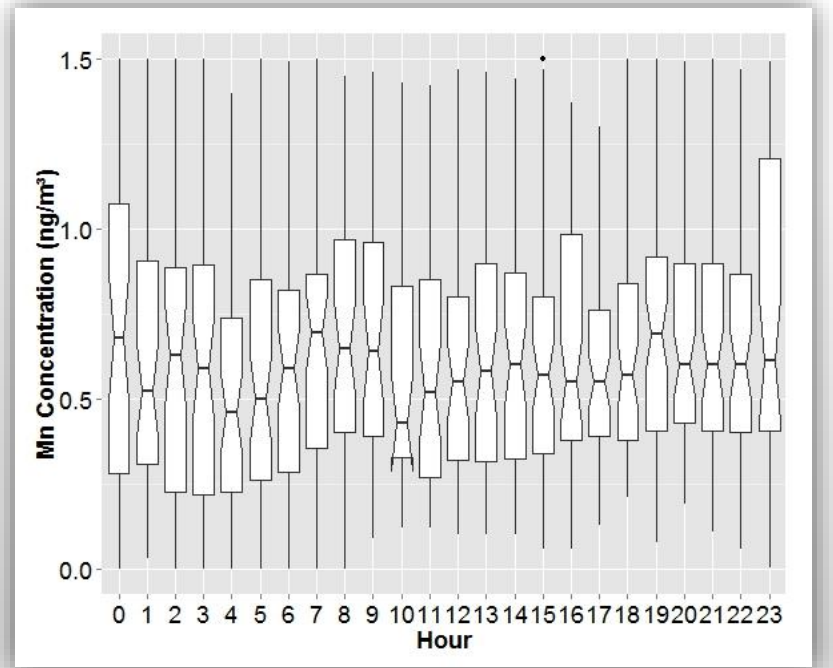
XRF Metals

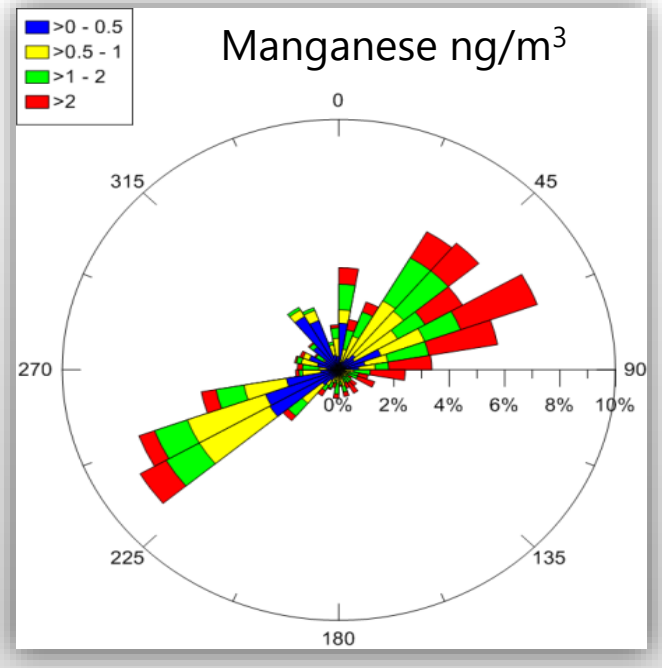
- Temporal & wind direction patterns were examined
- EPA PMF was used to evaluate potential sources



Metals

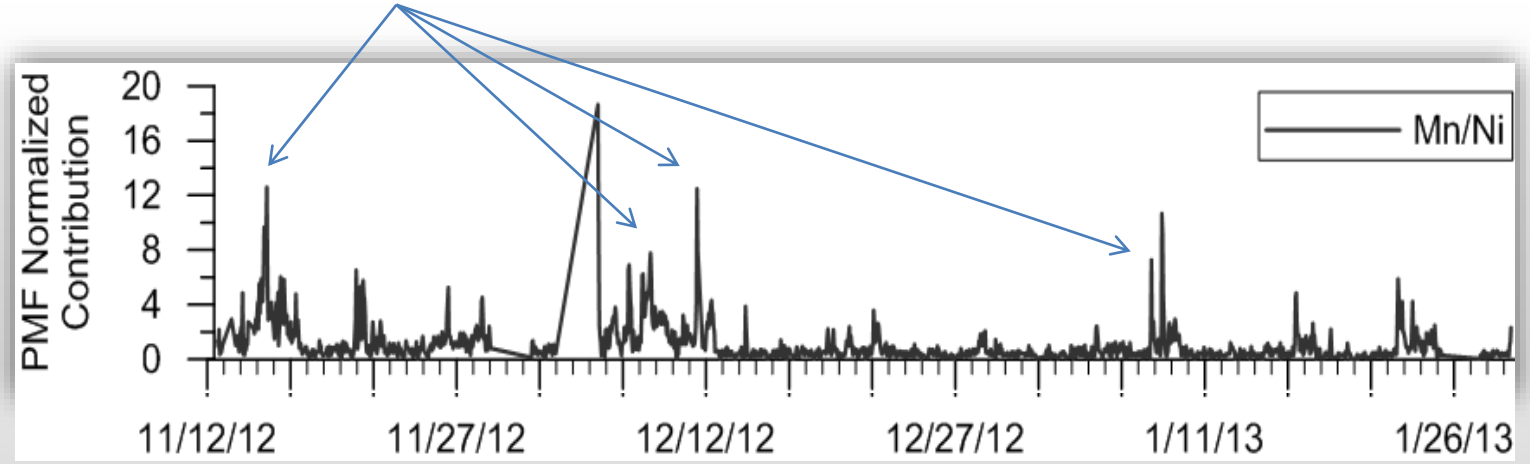
- Cu, Mn, and Pb show daytime spikes, similar to BC differential; other species showed mixed patterns.
- No species showed significantly higher concentrations when site was downwind of the oil field.





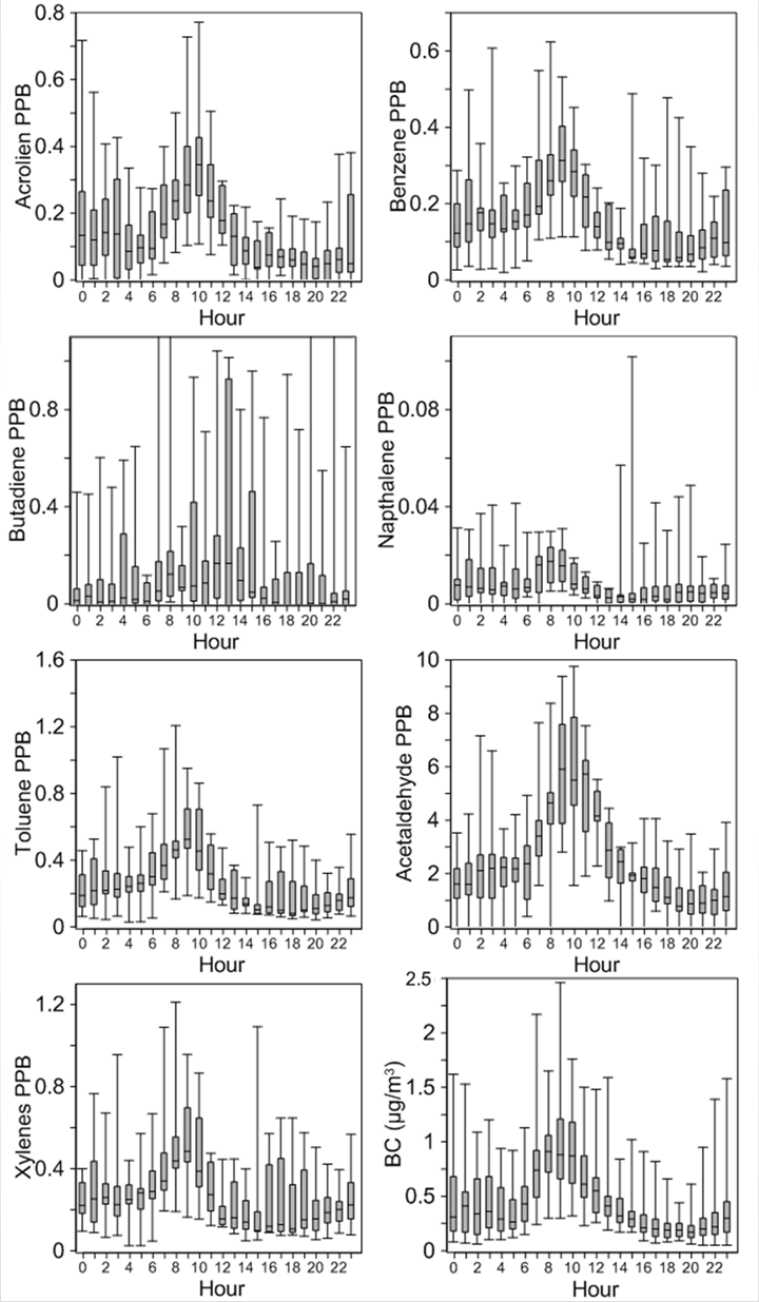
Metals Apportionment

- Identified multiple sources, including a factor with high Mn and Ni, likely associated with oil field operations.
- Spikes in Mn/Ni factor occurred coincident with operations activity and higher BC differential.



VOCs

- VOCs generally showed a similar diurnal pattern as BC.
- No consistent signal from oil operations was found.
- Some transient high concentration events occurred coincident with operations, but had low influence on average.



Summary

- Focus resources on the most important issues—in this case, DPM drives the risk estimates.
- Balance scope of work with available budget; year-round monitoring of metals, BC, and VOCs would be expensive, and may not be of sufficient temporal resolution.
- While transient high concentration events occurred coincident with oil field operations, there was no clear influence on ambient metals and VOCs.
- Only a small fraction of BC was attributed to oil field operations.

Reference & Acknowledgments

- California Environmental Protection Agency http://www.oehha.ca.gov/air/allrels.html.
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